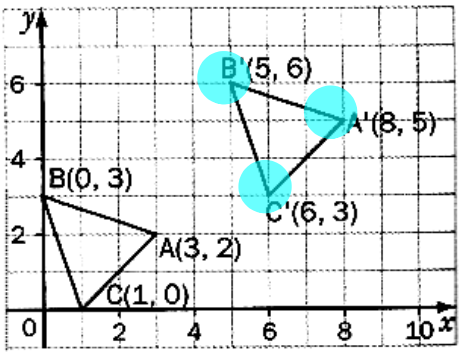
Worksheet 1-4: Transformations on a Coordinate Grid

1. Translations on a Coordinate Grid



A **translation**, or a shift, is a transformation that moves a figure to a new position in the same plane.

The diagram shows a translation. ΔABC has been translated horizontally to the right by 5 units and vertically upward by 3 units. The ordered pair of each vertex has been translated as the following:

$$(x, y) \rightarrow (x + 5, y + 3)$$

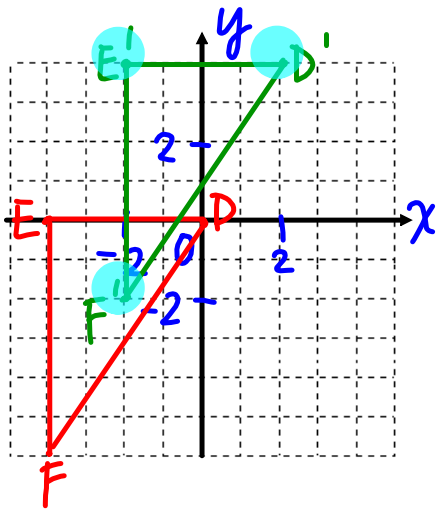
(a) ΔDEF has vertices D (0, 0), E (–4, 0), F (–4, –6)
Graph then find the vertices of the triangle after the translation: 2 units to the right and 4 units upward

x+2
y+4

D(0,0) → D'(2,4) (0+2, 0+4)

E(-4,0) → E'(-2,4) (-4+2, 0+4)

F(-4,-6) → F'(-2,-2) (-4+2, -6+4)



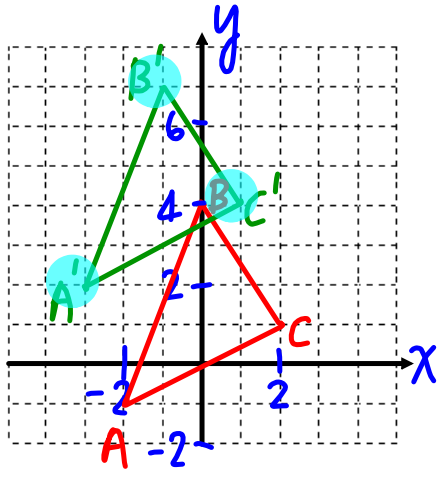
(b) ΔABC has vertices A (–2, –1), B (0, 4), C (2, 1)
Graph then find the vertices of the triangle after the translation: 1 unit to the left and 3 units upward

x-1
y+3

A(-2,-1) → A'(-3,2) (-2-1, -1+3)

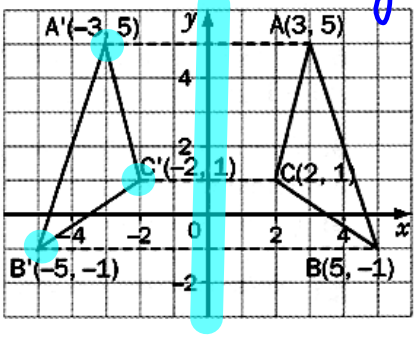
B(0,4) → B'(-1,7) (0-1, 4+3)

C(2,1) → C'(1,4) (2-1, 1+3)



2. Reflections on a Coordinate Grid

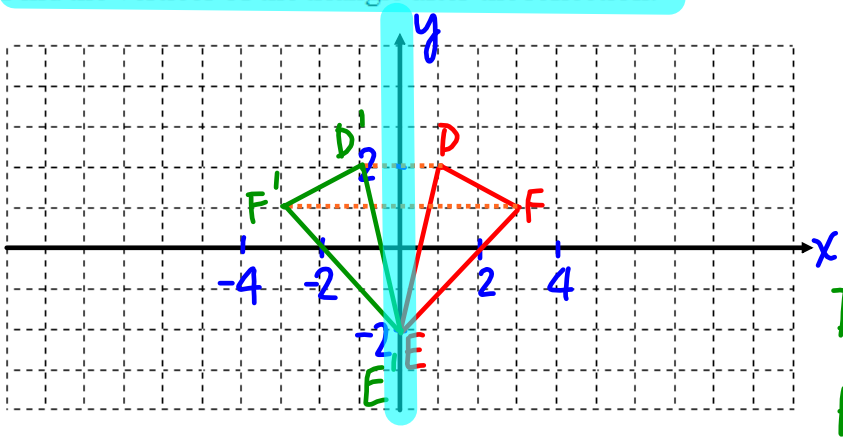
mirror image



A **reflection** is a transformation in which a figure is reflected over a mirror line or **reflection line**.

The diagram shows a reflection. ΔABC has been reflected in the *y*-axis, which is the line of reflection. Any point and its reflection image are the same distance from the reflection line.

(a) ΔDEF has vertices D (1, 2), E (0, –2), F (3, 1). Draw its reflection image in the *y*-axis. Find the vertices of the triangle after the reflection.



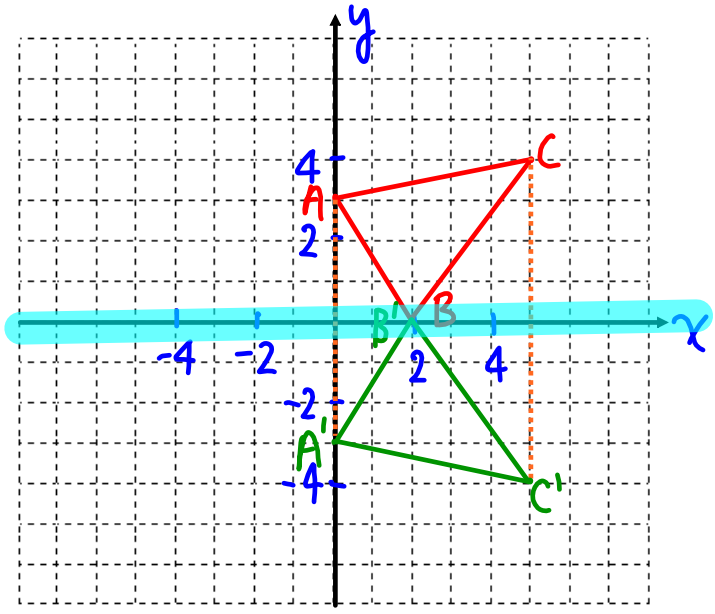
Multiply -1 to the x-values

D'(-1, 2)

E'(0, -2)

F'(-3, 1)

(b) ΔABC has vertices A (0, 3), B (2, 0), C (5, 4). Draw its reflection image in the *x*-axis. Find the vertices of the triangle after the reflection.



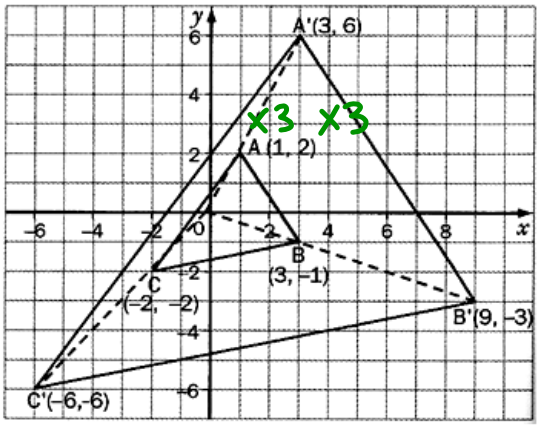
Multiply -1 to the y-values

A'(0, -3)

B'(2, 0)

C'(5, -4)

3. Dilatations on a Coordinate Grid



Factor
↓
Multiply
$\times \frac{1}{2}$ $(\div 2)$

A **dilatation** is a transformation that changes the size of an object. Dilatations are called enlargements or reduction, depending on the way in which the size is changed.

In an **enlargement**, an object is **stretched** to give a bigger image.
In a **reduction**, an object is **compressed** or shrunk to give a smaller image.

The factor by which the coordinates of points on a figure are multiplied to give the coordinates of the points on its dilatation image is called the scale factor. The diagram shows the dilatation of ΔABC with scale factor 3.

Note: A straight line can be drawn from the origin (0, 0) passing through A to A'. Similarly, a straight can also be drawn from the origin passing through B to B', and from the origin passing through C to C'. We can say that ΔABC has been enlarged by a dilatation with centre (0, 0).

So, the diagram shows a dilatation with centre (0, 0) and scale factor 3 can be modelled as:

$$(x, y) \rightarrow (3x, 3y)$$

In general, a dilatation with **centre (0, 0) and scale factor** k can be modelled as:

$$(x, y) \rightarrow (kx, ky)$$

When $k > 1$, the dilatation gives an **enlargement**. When $k < 1$, the dilatation gives a **reduction**.

4. Identify the scale factor for each of the following dilatation.

(a) $(x, y) \rightarrow (5x, 5y)$

5 (Enlargement)

(b) $(x, y) \rightarrow (\frac{1}{3}x, \frac{1}{3}y)$

$\frac{1}{3}$ (Reduction)

(c) $(x, y) \rightarrow (6x, 6y)$

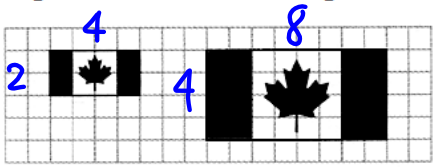
6 (Enlargement)

(d) $(x, y) \rightarrow (\frac{1}{4}x, \frac{1}{4}y)$

$\frac{1}{4}$ (Reduction)

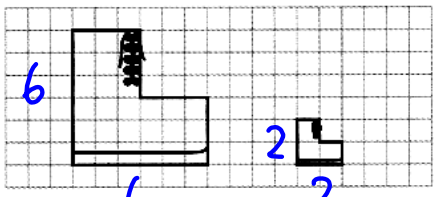
5. Each figure is shown with its image to the right. Find the scale factor of each dilatation.

(a)



Scale factor = 2

(b)

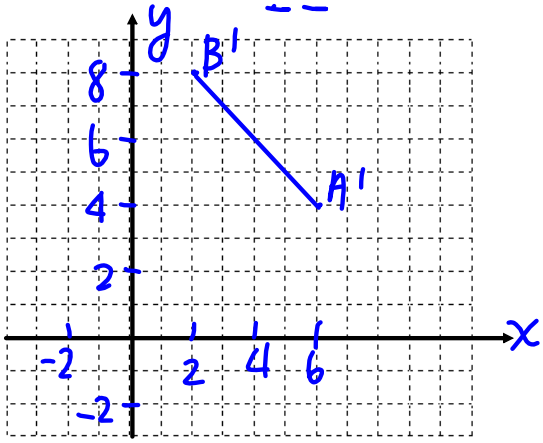


Scale factor = $\frac{1}{3}$

6. Draw the image of the line segment after each dilatation, and identify the coordinates of each image.

(a) Line segment: A(3, 2) and B(1, 4)

Dilatation: $(x, y) \rightarrow (2x, 2y)$

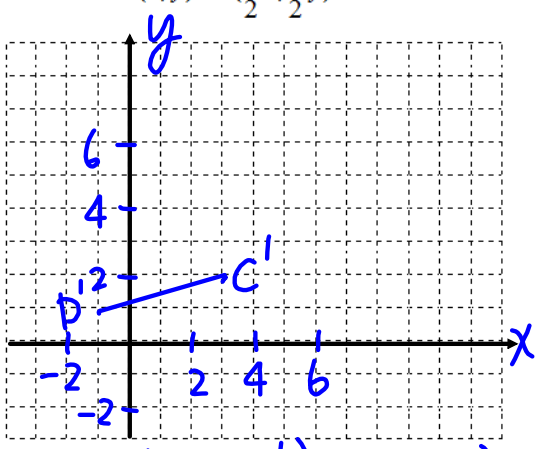


$A'(3\times2, 2\times2) = (6,4)$

$B'(1\times2, 4\times2) = (2,8)$

(b) Line segment: C(6, 4) and D(−2, 2)

Dilatation: $(x, y) \rightarrow (\frac{1}{2}x, \frac{1}{2}y)$

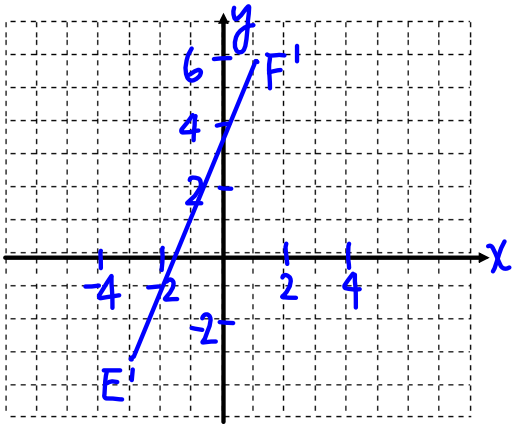


$C'(6\times\frac{1}{2}, 4\times\frac{1}{2}) = (3,2)$

$D'(-2\times\frac{1}{2}, 2\times\frac{1}{2}) = (-1,1)$

(c) Line segment: E(−1, −1) and F(1, 2)

Dilatation: $(x, y) \rightarrow (3x, 3y)$

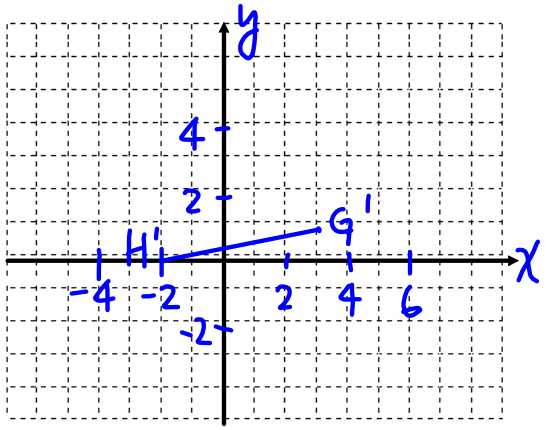


$E'(-1\times3, -1\times3) = (-3,-3)$

$F'(1\times3, 2\times3) = (1,6)$

(d) Line segment: G(9, 3) and H(−6, 0)

Dilatation: $(x, y) \rightarrow (\frac{1}{3}x, \frac{1}{3}y)$



$G'(9\times\frac{1}{3}, 3\times\frac{1}{3}) = (3,1)$

$H'(-6\times\frac{1}{3}, 0\times\frac{1}{3}) = (-2,0)$

Class starts in 2 minutes. Make sure you have your math work, textbook and calculator!

If you do not have any of these items, get it NOW!

If you are not ready to class when time is up, you stay quiet or go to the office.

No washroom or drink or locker or leaving your seat!!